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## Cross-cultural validation of the Student Nurse Stress Index Scale

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# Cross-cultural validation of the Student Nurse Stress Index Scale: A descriptive survey targeting student nurses in China

## Abstract

**Background:** Currently, relatively little is known regarding the sources and levels of stress experienced by nursing students in China. This is largely because there is no reliable and valid, culturally appropriate measure of student nurse' stress. A culturally acceptable, Chinese Version of the Student Nurse Stress Index Scale (SNSI-CHI), with established reliability and validity, is needed to identify sources of stress in Chinese nursing students.

**Methods:** This validation study used a cross-sectional descriptive survey design. Stratified cluster random sampling was used to collect data from August 2017 to January, 2018 from 1100 nursing students in Henan Province, China. A demographic questionnaire, SNSI-CHI and Perceived Stress Scale (PSS-14) were administered. Exploratory and confirmatory factor analysis was carried out on two randomly selected samples (each N=538) from the overall return. The content, construct, predictive and concurrent validity of the translated SNSI-CHI were examined.

**Results:** 1076 nursing students returned the survey (97.82% response rate). The average total score of SNSI-CHI was  $58.455 \pm 13.903$ . The internal consistency, test-retest reliability and content validity of the SNSI-CHI was excellent with a content validity index of 0.954. A four factor simple structure was revealed and confirmed using exploratory (explaining 75% of the variance) and confirmatory factor analysis ( $\chi^2/df=1.347$ , GFI=0.956, AGFI=0.945, RMR=0.032, RMSEA=0.025, NFI=0.974, IFI=0.993, TLI=0.992, CFI=0.993). This structure, i.e. academic load, clinical concerns, interface worries and personal problems compared well with the original SNSI. The SNSI-CHI totals and subscales showed good concurrent and predictive validity with the PSS-14 as comparator or criterion. A score of higher than 65 on the SNSI-CHI indicates high levels of perceived stress symptoms. Some 10.5% of respondents experience high levels of stressful demand. Sensitivity and specificity values of 71.7% and 75.1% respectively, demonstrated good predictive validity.

**Limitations:** This study sample was confined to the Henan Province, which may limit its generalizability. A larger and more diverse sample is needed in the future research.

**Conclusions:** The SNSI-CHI is both reliable and valid and culturally appropriate for use in China and its structure enables cross-cultural comparison.

**Keywords:** Nursing student, stress, reliability, validity, cross-cultural comparison

## 1. Introduction

Stress has been described as a negative emotional experience which occurs when individuals perceive themselves to be subject to excessive demands, or demands with which they cannot cope (Cox and Griffiths, 2010). Stress results from a dynamic interaction between the person and their environment resulting in the potential for both positive and negative reactions to perceptions of demand (Sinha et al., 2016). Positive effect, or eustress, may improve energy and alertness levels (Selye, 1965), whereas negative affect or distress, is more likely to result in more problematic physical (headache, fatigue, etc.), psychological (anxiety, anger, etc) and behavioral consequences for the person (such as smoking, drinking, etc.) (Song and Lindquist, 2015).

Many students experience high levels of stress at the onset of their university education due to the many wide-ranging challenges they face when adapting to the demands in this new environment (Ranjbar, 2016). This is especially true in nursing students. The volume, extent and complexity of the required theoretical knowledge combined with worries regarding difficulty of homework and exams, fear of failure, peer competition, and developing sufficient competence in both academic study and nursing skills are all key demands that create stress and concern for the students (Alzayyat and Al-Gamal, 2014).

Nursing is an applied science which requires the nursing student to integrate theory and practice, i.e. to assimilate wide-ranging theory and apply this critical understanding in their practice. Student nurses experience considerable academic demand combined with real clinical concerns regarding the well-being of their patients as they develop their practical skills (Sarikoc et al., 2017). Nursing students

often experience high levels of stress during their first clinical experiences, as they realize that they are responsible for the safety of their patients. Perhaps as a result, they worry about making mistakes, and often report feelings of distress, despite the support from their academic and clinical supervisors (Sarikoc et al., 2017).

Developing relationships with patients, their relatives, clinical instructors, other healthcare professions are essential elements of the student nurses' emergent role set and are also perceived as a source of demand. Student nurses report that concerns regarding insufficient professional training and a lack of practical knowledge, leads them to feel vulnerable and unprepared (Sercekus and Baskale, 2016). The lack of free time and reduced opportunity for entertainment or engaging with family members may also cause stress in student nurses (Pulido-Martos et al., 2012).

The sources of stress facing student nurses have been categorised in several different, yet complementary ways. The 43-item Beck and Srivastava Stress Inventory (BSSI) scale identifies that the sources of stress of nursing students include academic stress, death of patients; lack of understanding, college-home interface, and course organization and resources (Beck and Srivastava, 1991). Deary and his collaborators (2003) identify four broad concerns including: clinical, confidence, education and finance, moreover, they developed a 43-item scale to evaluate the stressors faced by nursing students (the Stressors in Nursing Students Scale, SINS). Costa and Polak (2009) suggest that six factors or categories capture the stressors facing student nurses: environment, performance of practical activities, professional communication, time management, professional education, and theoretical activity. They developed a 30-item Instrument for Assessing Stress among Nursing Students (ASNS). Gibbons (2009) classified stress factors into three areas: learning and teaching; placement-related and course organization, with a 29-item questionnaire Index of Sources of Stress in Nursing Students (ISSN).

However, while a number of questionnaires to measure stress exist, many of the scales used to assess the sources of stress faced nursing students have not been developed and evaluated with sufficient psychometric rigor (Jones and Johnston 1999; Pulido-Martos et al., 2012). The Student Nurse Stress Index Scale (SNSI) (Jones and

Johnston) is a 22-item self-reported instrument designed to measure the sources and levels of stress in students nurses, with a stable, simple structure, with clear content, and excellent reliability and validity established in several international settings. For example, in United Kingdom (Jones and Johnston, 1999), scale reliabilities indicated by Cronbach's  $\alpha$  exceeded 0.70 for all four factors and construct validity was acceptable with CFI=0.87 GFI=0.86. In America, an average Cronbach's  $\alpha$  for the 4 factors of 0.89 (Baker, 2012) was reported. In Turkey, a content validity index of 0.97 was reported, along with excellent construct validity CFI=0.94, GFI=0.89 (Sarikoc et al., 2017). Accordingly, student nurse stress has a robust, repeatable four factor structure including academic load, clinical concerns, interface worries and personal problems. This structure aligns well with findings from a recent systematic review which provides a critical analysis of the field and concludes that three broad areas of stressors face student nurses i.e. academic stressors, clinical stressors and personal/social stressors (Pulido-Martos et al., 2012).

Currently, Perceived Stress Scale (PSS-14) is designed for use in the general adult population to measure stress outcomes and is widely used in China following its translation and validation (Guo et al., 2018). This measure is a culturally appropriate, reliable and valid measure of stress outcome (emotion, sense of control) against which it is possible to validate a Chinese version of the SNSI.

Currently, there is no generally accepted, culturally appropriate scale to accurately measure the sources of stress experienced by the nursing students in China. Therefore, it is important to identify such a tool and demonstrate its reliability and validity and to enable cross-cultural comparison (Mirzaei et al., 2012) to accurately assess the stressors facing nursing students in China. Thus, this study aims to translate and adapt the SNSI scale into the Chinese context and to verify its validation for the future usage in Chinese nursing students.

## **2. Aim and Objective**

The aims of this study were 1) to test the reliability of SNSI-CHI including internal consistency, item-to-total correlation, inter-item correlation and intra-class

correlation; 2) to verify its content validity and construct validity; 3) and then assess concurrent validity and predictive validity from comparing the use Perceived Stress Scale (PSS-14) among Chinese nursing students.

### **3. Methods**

#### **3.1. Design and Setting**

This cross-sectional descriptive validation study was conducted from August 2017 to January 2018, in Henan Province, which is located in the central part of People's Republic of China. There are five medical colleges or universities each of which have Schools of Nursing and which offer a four-year bachelor degree nursing program. A total of 2500 nursing graduates emerge every year. In China and also in Henan, the nursing Bachelor degree is taught over four years. The curriculum comprises School-based nursing theory and research methodology, alongside hospital placements and direct patient interactions. For the first three years, students undertake clinical practice for a month in every summer and winter vacation, ahead of an extended period of clinical practice in the full last year. Entry is highly competitive, and requires high grades in the standardised National College Entrance Examination (NCEE). Fewer than 10% of candidates can achieve the lowest admission score for Schools of Nursing with baccalaureate program.

#### **3.2. Participates Inclusion**

Inclusion criteria included: (1) Participant were  $\geq 18$  years old; (2) currently enrolled in a baccalaureate science of nursing program; (3) literate; (4) had experienced clinical practice time  $\geq 1$  month and (5) provided consent to participate. Exclusion criteria included students who were absent during the survey period.

#### **3.3. Instruments**

The questionnaire captured three parts: demographic variables, the SNSI-CHI and Perceived Stress Scale (PSS-14).

Demographic variables: included contact information, homeplace, household income, number of sibling, age, gender, height, weight, body mass index (BMI), grade, student leaders status, marital status, amount of sleep on average per night, physical

health condition, and total clinical practice time. Biological, psychological and sociocultural factors were measured as they are likely to be correlated with stress (Sun et al., 2016; McCarthy et al., 2018; Smith et al., 2017). BMI may also closely relate to stress, as an individual may lose appetite, or overeat following exposure to stressors (Lu et al., 2016).

The Student Nurse Stress Index Scale (SNSI) (Jones and Johnston, 1999) was developed to provide a robust measure of nursing student stress with excellent reliability and validity. It consists of 22 items clustered into four factors: academic load (items 1, 2, 3, 8, 14, 18, and 20), clinical concerns (items 13, 14, 16, 17, 18, 19, 20), interface worries (items 4, 5, 6, 7, 15, 21, and 22) and personal problems (items 9, 10, 11, and 12). SNSI uses a five-point Likert scale ranging from 1 (not stressful) to 5 (extremely stressful). The total score ranges from 22 to 110, and the higher scores demonstrate a higher level of perceived demand or sources of stress.

The Perceived Stress Scale (PSS-14) investigates stress as an outcome and the extent to which respondents perceived that their stress is unpredictable, uncontrollable and overwhelming (Liu et al., 2017). The PSS-14 showed an excellent reliability and validity in China (Yang and Huang, 2003). This measure comprises 14 items and two subscales: Sense of being out of control (item 4, 5, 6, 7, 9, 10 and 13) and Feeling of tension (item 1, 2, 3, 8, 11, 12 and 14). The PSS-14 uses a five-point Likert scale. Each item is scored from 0 (strongly disagree) to 4 (strongly agree) and summed. The total score varies from 0 to 56, and higher scores indicate a higher level of stress as an outcome.

### **3.4. Cross-culture Adaption**

Culture is defined as learned, shared and transmitted knowledge of values, beliefs, norms and lifeways of a particular group that guides an individual or group in their thinking, decisions, and actions in patterned way (Leininger, 1988). It is recognized that if questionnaires are to be used across cultures, the items must not only be translated well linguistically, but also must be adapted culturally to maintain the content validity of the instrument at a conceptual level across different cultures (Beaton et al., 2000).

The original English version of SNSI is authorized and provided by its original author via an email, and some translation steps were undertaken according to Brislin's translation guidelines (Brislin, 1970) and cross-cultural adaption guidelines (Beaton et al., 2000; Wild et al., 2005). Moreover, the original author participated in the whole process and gave guidance throughout the study.

In the first step the SNSI was translated from English into Chinese by a professional, bilingual translator. An independent translator then performed a back translation. In the next step, any discrepancies between the original and back translation of the SNSI was explored by a panel of bilingual people which included three nursing and two psychology experts. In this way the cultural and linguistic equivalence of the equivalence of each item was confirmed. For example, the direct translation of some words "entertainment" and "feedback" were modified into culturally adapted words such as "rest or relax" and "attention, recognition and feedback", respectively. In the third step, the translated SNSI, the SNSI-CHI, was piloted for acceptability with 10 nursing students. Amendments to the wording of items were made according the participant's comments. A consensus was sought and achieved amongst participants that the SNSI-CHI had clear wording, clarity and excellent cultural equivalence.

Henan's culture is similar to China's culture in almost all aspects, also the translators were from different parts of China. Hence, the translation is likely to be acceptable across China.

### **3.5. Ethics**

The Ethical Review Board of Zhengzhou University, Zhengzhou, Henan, China, approved this study. All participants received participant information details at the beginning of the interview. All participants indicated their informed consent to participate in writing (Declaration of Helsinki, 2013).

### **3.6. Data collection**

A stratified cluster random sampling of nursing students were recruited from Schools of Nursing in medical colleges or universities in Henan Province from August 2017 to January, 2018.



Two medical colleges or universities were randomly selected from five in Henan Province, and were then stratified them into four layers according to grade (Freshman, sophomore, junior and senior); then six classes were randomly selected in each layer. Survey stations were established in the classrooms in School of Nursing and the nursing students were invited to approach.

Four investigators received training in the administration of the questionnaires and a preliminary pilot was carried out with 60 nursing students. This identified possible problems in the investigators understanding of particular SNSI-CHI items and the questionnaire was revised where necessary. A one-to-one, face-to-face data collection method was then used in this study. The questionnaire used was completed or answered voluntarily by the participants in the classroom settings. Data collection was both private and anonymous.

The targeted sample was 1100 nursing students, and 1076 of them completed the survey, providing a complete response rate 97.82%. The study sample exceeded key psychometric criteria of 20:1 subjects to number of scale items ratio (Pedhazur, 1997) and exceeded the specification of  $N > 1,000$  as "excellent" (Comfrey and Lee, 1992). Our targeted sample met the general rule in psychometric research that a large sample is essential (Osborne and Costello, 2004).

### **3.7. Data analyses**

Data analysis and management used SPSS (version 21.0; IBM Corp, Armonk, NY, USA) and AMOS (version 22.0; SPSS Inc., Chicago, USA). This adhered to the COSMIN (COnsensus-based Standards for the selection of health Measurement INstruments) guideline (Mokkink et al., 2016; Mokkink et al., 2010).

The internal consistency of the SNSI-CHI was estimated using Cronbach's  $\alpha$ . Item-to-total and inter-item correlations were calculated using Pearson's correlation coefficients. Stability was estimated by test-retest correlation coefficient (intra-class correlation coefficient, ICC).

The content validity of the SNSI-CHI was calculated using item level content validity index (I-CVI) and scale level content validity index (S-CVI). The S-CVI includes S-CVI/UA (universal agreement), the proportion of items on a scale that

received relevancy ratings of 3 or 4 by all the experts, and S-CVI/Ave (average), i.e. the average of the I-CVIs for all items on the scale (Polit and Beck, 2006). A panel of clinical and theoretical experts scored each item of the SNSI-CHI. Two head nurses, two nursing professors and two expert clinical practitioners rated each item as either: 1=not relevant; 2=somewhat relevant; 3=quite relevant; and 4=highly relevant. The "quite relevant" and "highly relevant" were given a score of one, all other ratings received a score of zero. The construct validity of the SNSI-CHI was established using Exploratory (EFA) and confirmatory factor analysis (CFA). The total sample was split randomly into two groups. An initial EFA was conducted with one group of 538 participants. The CFA was then undertaken on data from the independent second group of 538 participants. Concurrent validity of the SNSI-CHI was explored using Pearson correlation coefficients and the PSS-14.

The predictive validity of the SNSI-CHI was estimated using Receiver operator characteristic (ROC) curves, measures of sensitivity and specificity, and the Youden's index. The PSS-14 as criterion allowed classification of participants into those with high ( $PSS-14 \geq 27$ ) and low stress ( $PSS-14 < 27$ ) symptoms (Chen et al., 2015).  $P < 0.05$  was defined as statistically significant.

## **4. Results**

### **4.1. The sample**

Of the 1076 nursing students, 795(73.9%) were from rural and 281(26.1%) urban areas; 80(7.4%) were male and 996 (92.6%) were female. Age ranged from 18 to 25, with a mean value of  $21.16 \pm 1.24$  years. (See Table 1).

### **4.2. Reliability**

The total Cronbach's  $\alpha$  of the SNSI-CHI was 0.886, each factor was 0.885, 0.887, 0.892 and 0.874, respectively. The deletion of two items (item 7 and 20) would improve the overall Cronbach's  $\alpha$  for the overall measure (Table 2). The item-to-total correlations ranged between  $r = 0.351$  and  $r = 0.664$ , with an average correlation of  $r = 0.569$  (Table 2). The inter-item correlations ranged from  $r = 0.120$  to  $r = 0.669$  and the test-retest ICC of SNSI-CHI was 0.996 (95% CI, 0.992-1.00,  $P < 0.001$ ). The

Cronbach's  $\alpha$  of PSS-14 was 0.719.

### **4.3. Validity**

#### **4.3.1. Content validity**

The S-CVI/UA and S-CVI/Ave provided values of 0.954 and 0.727, respectively. Six experts assessed the content validity of the items of the SNSI-CHI by rating the I-CVIs of each item. This ranged from 0.833-1.000.

#### **4.3.2. Construct validity**

In the EFA the Kaiser-Meyer-Olkin (KMO) was 0.963, and Bartlett's Test of Sphericity was 10389.365 and statistically significant ( $P < 0.01$ ). Principal components analysis extracted four factors with eigenvalues  $>1.00$  which explained 75.013% of the total variance. The factor loadings and communality values can be seen in **Table 3**. In the CFA the fit indices for this four factor structural equation model of the SNSI-CHI were CMIN/DF = 1.404, GFI= 0.954, AGFI = 0.943, CFI = 0.992, TLI = 0.991, RMSEA = 0.027, RMR =0.032, respectively. Four factors and items distribution were as following: academic load (item 1, 2, 3, 8, and 20), clinical concerns (item 13, 14, 16, 17, 18, 19), interface worries (item 4, 5, 6, 7, 15, 21, and 22) and personal problems (item 9, 10, 11, and 12). **Figure 1** shown the structural equation model and the standardized regression coefficients of four-factor model of SNSI-CHI.

### **4.4. Concurrent validity**

The total scores of the SNSI-CHI and PSS-14 were positively correlated ( $r = 0.493$ ,  $P < 0.01$ ), and the correlations of the SNSI-CHI subscales with the subscales of the PSS-14 ranged from  $r = 0.330$  to  $r = 0.844$ . Sense of being out of control had the weakest positive correlation with the SNSI-CHI subscale Personal problems ( $r = 0.330$ ,  $P < 0.01$ ), and had the strongest positive correlation with the PSS-14 ( $r = 0.844$ ,  $P < 0.01$ ), than other correlations. (See **Table 4**).

### **4.5. Predictive validity**

With PSS-14 as criterion, the optimal cut-point for the area under the receiver operator characteristic (ROC) curve of SNSI-CHI was 0.773 (95% CI: 0.727-0.820,  $P < 0.005$ ), **Fig. 2**. The optimal cut-point was 65, and sensitivity and the specificity

were 71.7% and 75.1%, respectively. In other words, a total score  $\geq 65$  of SNSI-CHI indicated a high level of perceived stress symptoms; whereas the total score  $< 65$  of SNSI-CHI indicated a lower level perceived stress symptoms, The  $PPV = a / (a + c) = 82.8\%$ ,  $NPV = d / (b + d) = 96.7\%$ .

#### 4.6. Descriptive analysis of SNSI-CHI

Scores on the SNSI-CHI ranged from 22 to 110 with a mean for all items was  $58.455 \pm 13.903$ . The item "not having enough time for family" ( $2.982 \pm 1.160$ ) had the highest mean score, followed by "peer competition" ( $2.892 \pm 1.012$ ), "fear of failing in course" ( $2.853 \pm 1.056$ ), and "examination and/or grades" ( $2.852 \pm 1.071$ ). "Relationships with parents" had the lowest mean score of  $1.972 \pm 0.990$ . See Table 2.

### 5. Discussion

This study is the first to test the reliability and establish cross-cultural validity of the SNSI in a sample of Chinese nursing students. The findings, which support the reliability and validity of the Chinese version of the SNSI (SNSI-CHI) in this population, are compared and contrasted with other translated versions of the SNSI measure.

The SNSI-CHI shows better internal consistency ( $\alpha$  of 0.886) than the Turkish version (0.86) (Sarıkoc et al., 2017) and American version in which all subscales apart from the personal problems subscale just exceed 0.70 (Baker, 2012). The Cronbach's  $\alpha$  reported within all of the SNSI translation studies exceed the recommended standard ( $\geq 0.70$ ) ((Guo et al., 2017; Terwee et al., 2007).

In this study, deletion of SNSI items did not improve the scale total Cronbach's alpha, with two exceptions. Deletion of items 7 and 20 lead to improved Cronbach's  $\alpha$  of 0.898 and 0.888, respectively. Item 7 "College/School response to student needs" identifies that the relationship between the organisation and student need is a key source of stress for students and this mitigates against its deletion. This suggests, therefore, that senior academics administering nurse education in this setting need to identify, be aware of and respond to student need. Student need is a basic condition for maintaining human survival and development, and is a basic driving force of

individual psychological activities and behaviors (Perlovsky, 2016). The satisfaction of individual need is thought to eliminate or relieve the anxiety and pain experienced, reduce perceptions of pressure and maintain a good sense of self and comfort (Orlando, 1987). Item 20 (not clear in their goals) captures perceptions about self-realization and identifies that this is also a key source of stress for student nurses in this setting, suggesting that this item should also be retained. A lack of self-realization is a major concern for students which may subsequently lead to future anxiety, stress and depression and other negative emotions Maslow (1987). Although there were some limitations surrounding the reliability of items 7 and 20, they were retained given their theoretical importance.

The inter-item correlations of SNSI-CHI ranged from 0.30 to 0.70, except for items 7 and 11 ( $r=0.120$ ), which measured "College/School response to student needs" and "Relationships with parents". The item-to-total correlations ranged from 0.351 to 0.664 ( $P<0.001$ ), with an average correlation of 0.569. The SNSI-CHI has good internal consistency reliability (Guo et al., 2017; Sijtsma, 2009). The test-retest ICC was 0.996 (95% CI, 0.992-1.00,  $P<0.001$ ), which exceeds the recommended criterion of 0.90 (Nunnally and Bernstein, 1994) indicating temporal stability.

In our study, the I-CVIs ranged between 0.833 and 1.000. The SNSI-CHI showed good content validity, the S-CVI/UA and S-CVI/Ave was 0.818 and 0.700 respectively. Indicators of good content validity include  $I-CVI \geq 0.80$ , an  $S-CVI/UA \geq 0.40$ , and an  $S-CVI/Ave \geq 0.90$  (Polit and Beck, 2006).

Construct validity was tested by EFA and CFA. The EFA revealed four factors accounting for 75.013% of the total variance, with all factor loadings of 22 items of SNSI-CHI exceeding 0.30 (Gao et al., 2015). The factor structure and amount of the accumulated variance found for the SNSI-CHI in this study was similar to the original study (Jones and Johnston, 1999) and other previous three studies (Sarikoc et al., 2017; Shukla et al., 2013; Baker, 2012). However, item 14 (too much responsibility), item 18 (Atmosphere created by teaching staff) and item 20 (I am not sure what is expected of me) loaded on both factor 1 (academic load) and factor 2 (clinical concerns) simultaneously, in the study of the original author (Jones and Johnston, 1999). In this

study, item 20 only belongs to the factor 1, while item 14 and item 18 only belong to factor 2.

SNSI-CHI has a simple structure, probably as a result of the excellent sample size. In addition, this finding maybe influenced by traditional Chinese culture and the form of nurse education in this setting. The protection of patient well-being is perhaps the most pressing or more pertinent demand facing student nurses in hospital and thus the “self-perceived responsibility of taking care of the patients” was reported as a most concerning issue in the clinical setting by the nursing students of this study (item 14). The clinical teaching experience by student nurses is usually one-to-one in this context, and the learning atmosphere created by teachers may have more immediate influence on students than teachers in the School of Nursing (asked by item 18) (Schmidt and Mamede, 2015; Zhou et al., 2016). A focus on achieving high test scores may be greater within the Universities of China (item 20), compared to Western culture (item 20) a broader assessment of attainment results in test scores being ranked as a comparatively less concerning source of stress (Khalaila, 2015). CFA was used to further verify the construct validity of the SNSI-CHI in the randomly selected independent sample and the results confirmed that the factor loadings and explained variances were strong and consistent with the EFA, with the four-factor structure associated with good model fit indexes.

Pearson's correlations between the total SNSI-CHI and PSS-14 scores and individual SNSI-CHI items with PSS-14 subscales were consistently strong and in the expected direction indicating good concurrent validity (Sousa et al., 2010) as seen previously. Significant correlations in the expected directions have been reported for the original English language-version of SNSI with Marlowe-Crowne Social Desirability Index (MC-SDS) in the Cohort 1/2 data set (Academic load,  $r=-0.23$ ,  $P<0.0005$ ; Clinical concerns,  $r=-0.31$ ,  $P<0.0005$ ; Interface worries,  $r=-0.23$ ,  $P=0.001$ ; Personal problems,  $r=-0.28$ ,  $P<0.0005$ ; SNSI total,  $r=-0.34$ ,  $P<0.0005$ ), and the General Health Questionnaire (30-item version, GHQ-30) in 1993/94 data set all correlations exceeded 0.26,  $P=0.001$  (Jones and Johnston, 1999).

The area under the ROC curve of SNSI-CHI was 0.773 in this study which

compares well with benchmark range between 0.5 and 1.0, with  $\geq 0.7$  indicating a good screening effect (Guo et al., 2017). The cut-off point of the Chinese version of the SNSI was 65, suggesting that the nursing students whose score was  $\geq 65$  perceived a high level of perceived stress symptoms. Approximately one in ten (114/1076=10.59%) of respondents experience high levels of stressful demand. This study is the first to identify the cut-off point (the value that distinguishes student response as negative or positive) of SNSI-CHI, however, additional follow-up studies are required to further confirm this.

In this study, the mean score of all items of SNSI-CHI was 58.455, which exceeded both Jones and Johnston' study in the United Kingdom (45.75) (Jones and Johnston, 1999) and Baker' study in America (not more than 25) (Baker, 2012). In addition, more than one-tenth of nursing students experienced high levels of stressful demand. One reason for this could be that Chinese students may enter the course having already been placed under duress by the NCEE to gain admission to the Bachelor degree nursing program. Following entry, students then encounter a new, heavily medical or life sciences-based curriculum, combined with a nursing clinical workload, while also having to navigate new social networks (You et al., 2015). In addition, nursing students face competition for employment, combined with the relatively lower social position of nursing in the inland area of China. This is especially true in Henan province which has a large population and a relatively poor state of social and economic development. Student nurses may also suffer a lack of professional identity and experience role stress, particularly as they are initially socialized into the nursing profession (Sun et al., 2016). As such, they may be more vulnerable and susceptible to negative emotion (i.e. stress, anxiety and depression) (You et al., 2015; Smith and Yang, 2017).

Ranking the score of each item from high to low identified the four most stressful items to be item 22 (not having enough time for family), item 4 (peer competition), item 8 (fear of failing in course), item 3 (examination and/or grades). Item 11 (relationships with parents) had the lowest mean score. The most demanding stressors experienced by nursing students in this setting are mainly due to a lack of

free time, peer pressure and fears surrounding exam failure, which is consistent with findings from a previous study (Song and Lindquist, 2015). "Relationships with parents" was a less acute source of stress for nursing students than other aspects possibly reflecting Chinese historical origins, living habits, values, customs and culture (Luk et al., 2017).

In summary, the SNSI-CHI is a short, reliable, and valid instrument that is appropriate for use with Chinese nursing students. The SNSI-CHI has few items, simple content and structure and is acceptable to students. It is easy to administer and can be useful for early detection of stress symptoms for Chinese nursing students. The study presented here has some limitations. For example, the study sample was confined to the Henan Province, which may limit its generalizability. A larger and more diverse sample would strengthen any future research. This study only assessed the negative influence of stress on nursing students, but did not evaluate the positive effects that pressure and challenges may have people. Sources of eustress related to enhanced performance, the achievement of clinical academic goals and positive well-being have still to be developed.

## **6. Conclusion**

This study is the first to examine the cross-cultural validity of the Student Nurse Stress Index Scale in this setting. The study is explored the psychometric properties of a Chinese version of the SNSI in the population of Chinese student nurses and has demonstrated excellent reliability and validity of the measure.

## **7. Relevance to clinical practice**

Although further research is needed to further confirm the measure's reliability and validity for nursing students stress in other settings in China, these findings show great promise for the use of this measure in Chinese nursing students.

## **8. Future Usage**

If other researchers want to use the Chinese Version of the Student Nurse Stress Index Scale (SNSI-CHI), please don't hesitate to contact the author Lina Guo ( [Email:guolina09@126.com](mailto:guolina09@126.com)) to obtain the translated version freely.



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The authors stated that they have no conflicts of interest.

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